

Serial No.: 10/506,363
Examiner: Eunha P. Cherry
Title: OPTICAL SCANNER AND IMAGE FORMING APPARATUS
Page 2 of 8

RECEIVED
CENTRAL FAX CENTER

JUN 11 2007

Amendments to the Claims:

This listing of claims will replace all prior versions, and listing, of claims in the application.

1. (Canceled)

2. (Currently amended) The optical scanner according to claim 5 [[1]], further comprising:

a first image forming optical system that is disposed between the light source part and the optical deflector and allows a linear image to be formed on a deflection surface of the optical deflector,

wherein the first reflecting optical element is formed of a curved surface mirror, and is disposed between the optical deflector and a surface to be scanned and constitutes a second image forming optical system, and

the first image forming optical system, the optical deflector, and the second image forming optical system are disposed respectively in different positions in a sub-scanning direction so that a light beam from the first image forming optical system is incident obliquely relative to a plane that includes a normal line to the deflection surface of the optical deflector and is parallel to a main scanning direction, and so that a light beam from the optical deflector is incident obliquely relative to a plane that includes a normal line at a vertex of the curved surface mirror and is parallel to the main scanning direction (hereinafter, referred to as a "YZ plane").

3. (Currently amended) The optical scanner according to claim 5 [[1]],

wherein the first reflecting optical element is formed of a curved surface mirror, and the curved surface mirror has a shape symmetrical with respect to a plane that includes a normal line at a vertex of the curved surface mirror and is perpendicular to a main scanning direction (hereinafter, referred to as an "XZ plane").

4. (Currently amended) The optical scanner according to claim 5 [[1]],

Serial No.: 10/506,363
 Examiner: Euncha P. Cherry
 Title: OPTICAL SCANNER AND IMAGE FORMING APPARATUS
 Page 3 of 8

wherein the second reflecting optical element reflects a light beam reflected from the optical deflector and a light beam reflected from the first reflecting optical element by using a common surface of the second reflecting optical element.

5. (Previously presented) An optical scanner, comprising:

first and second reflecting optical elements,

wherein the second reflecting optical element is disposed so as to reflect incident light to be incident on the first reflecting optical element and reflected light from the first reflecting optical element,

wherein the second reflecting optical element reflects the incident light to be incident on the first reflecting optical element and the reflected light from the first reflecting optical element by using a common surface of the second reflecting optical element, and

wherein the first reflecting optical element is formed of a curved surface mirror, and when a distance between the first reflecting optical element and the second reflecting optical element along a normal line at a vertex of the curved surface mirror is indicated as l , an angle formed by a center axis of incident light to be incident on the first reflecting optical element and a plane that includes the normal line at the vertex of the curved surface mirror and is parallel to a main scanning direction as θM , a width of the incident light on the first reflecting optical element in a sub-scanning direction as dm , a width of the incident light to be incident on the first reflecting optical element on the second reflecting optical element in the sub-scanning direction as di , and a width of reflected light from the first reflecting optical element on the second reflecting optical element in the sub-scanning direction as do , the following conditional expression (1) is satisfied:

$$\frac{dm}{2} + 1 \leq 2l \tan \theta M \leq \frac{di}{2} + \frac{do}{2} + 2 \quad \dots(1).$$

6. (Previously presented) An optical scanner, comprising:

first and second reflecting optical elements,

Serial No.: 10/506,363
 Examiner: Eunha P. Cherry
 Title: OPTICAL SCANNER AND IMAGE FORMING APPARATUS
 Page 4 of 8

wherein the second reflecting optical element is disposed so as to reflect incident light to be incident on the first reflecting optical element and reflected light from the first reflecting optical element,

wherein the second reflecting optical element reflects the incident light to be incident on the first reflecting optical element and the reflected light from the first reflecting optical element by using a common surface of the second reflecting optical element, and

wherein the first reflecting optical element is formed of a curved surface mirror, and when a distance between the first reflecting optical element and the second reflecting optical element along a normal line at a vertex of the curved surface mirror is indicated as l , a distance between the first reflecting optical element and the second reflecting optical element along a center axis of incident light to be incident on the first reflecting optical element as Lmi , a distance between the first reflecting optical element and the second reflecting optical element along a center axis of reflected light from the first reflecting optical element as Lmo , an angle formed by the center axis of the incident light to be incident on the first reflecting optical element and a plane that includes the normal line at the vertex of the curved surface mirror and is parallel to a main scanning direction as θM , a width of the incident light on the first reflecting optical element in a sub-scanning direction as dm , a distance from a deflection surface of the optical deflector to a vertex of the first reflecting optical element as L , and a distance from the vertex of the first reflecting optical element to a surface to be scanned as D , the following conditional expression (1) is satisfied:

$$\frac{dm}{2} + 1 \leq 2l \tan \theta M \leq \frac{di}{2} + \frac{do}{2} + 2 \quad \dots(1)$$

where di and do are approximated by the following expressions (2) and (3), respectively:

$$di = dm \times \frac{L - Lmi}{L} \quad \dots(2)$$

$$do = dm \times \frac{D - Lmo}{D} \quad \dots(3).$$

Serial No.: 10/506,363
Examiner: Eunha P. Cherry
Title: OPTICAL SCANNER AND IMAGE FORMING APPARATUS
Page 5 of 8

7. (Currently amended) The optical scanner according to claim 5 [[1]],

wherein the first reflecting optical element is disposed in a space interposed between a light beam reflected from the optical deflector to be incident on the second reflecting optical element and a light beam reflected last from the second reflecting optical element.

8. (Currently amended) The optical scanner according to claim 5 [[1]], further comprising:

a third reflecting optical element that reflects a light beam reflected last from the second reflecting optical element,

wherein the first reflecting optical element is disposed in a space bounded by the second reflecting optical element, a light beam reflected from the optical deflector to be incident on the second reflecting optical element, the light beam reflected last from the second reflecting optical element to be incident on the third reflecting optical element, and a light beam reflected from the third reflecting optical element.

9. (Original) The optical scanner according to claim 2,

wherein the first reflecting optical element has a shape that permits compensation for a curve of a scanning line that occurs due to oblique light incidence.

10. (Original) The optical scanner according to claim 2,

wherein the curved surface mirror has a skew shape in which a normal line at each of points other than the vertex on a generatrix that is a curved line where a surface of the curved surface mirror intersects with the YZ plane is not included in the YZ plane.

11. (Currently amended) An image forming apparatus comprising an optical scanner as claimed in claim 5 [[1]].

12. (New) The optical scanner according to claim 6, further comprising:

Serial No.: 10/506,363
Examiner: Eunha P. Cherry
Title: OPTICAL SCANNER AND IMAGE FORMING APPARATUS
Page 6 of 8

a first image forming optical system that is disposed between the light source part and the optical deflector and allows a linear image to be formed on a deflection surface of the optical deflector,

wherein the first reflecting optical element is formed of a curved surface mirror, and is disposed between the optical deflector and a surface to be scanned and constitutes a second image forming optical system, and

the first image forming optical system, the optical deflector, and the second image forming optical system are disposed respectively in different positions in a sub-scanning direction so that a light beam from the first image forming optical system is incident obliquely relative to a plane that includes a normal line to the deflection surface of the optical deflector and is parallel to a main scanning direction, and so that a light beam from the optical deflector is incident obliquely relative to a plane that includes a normal line at a vertex of the curved surface mirror and is parallel to the main scanning direction (hereinafter, referred to as a "YZ plane").

13. (New) The optical scanner according to claim 12,

wherein the first reflecting optical element has a shape that permits compensation for a curve of a scanning line that occurs due to oblique light incidence.

14. (New) The optical scanner according to claim 12,

wherein the curved surface mirror has a skew shape in which a normal line at each of points other than the vertex on a generatrix that is a curved line where a surface of the curved surface mirror intersects with the YZ plane is not included in the YZ plane.

15. (New) The optical scanner according to claim 6,

wherein the first reflecting optical element is formed of a curved surface mirror, and the curved surface mirror has a shape symmetrical with respect to a plane that includes a normal line at a vertex of the curved surface mirror and is perpendicular to a main scanning direction (hereinafter, referred to as an "XZ plane").

Serial No.: 10/506,363
Examiner: Eunha P. Cherry
Title: OPTICAL SCANNER AND IMAGE FORMING APPARATUS
Page 7 of 8

16. (New) The optical scanner according to claim 6,
wherein the second reflecting optical element reflects a light beam reflected from the optical deflector and a light beam reflected from the first reflecting optical element by using a common surface of the second reflecting optical element.
17. (New) The optical scanner according to claim 6,
wherein the first reflecting optical element is disposed in a space interposed between a light beam reflected from the optical deflector to be incident on the second reflecting optical element and a light beam reflected last from the second reflecting optical element.
18. (New) The optical scanner according to claim 6, further comprising:
a third reflecting optical element that reflects a light beam reflected last from the second reflecting optical element,
wherein the first reflecting optical element is disposed in a space bounded by the second reflecting optical element, a light beam reflected from the optical deflector to be incident on the second reflecting optical element, the light beam reflected last from the second reflecting optical element to be incident on the third reflecting optical element, and a light beam reflected from the third reflecting optical element.
19. (New) An image forming apparatus comprising an optical scanner as claimed in claim 6.